Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Promoting Interoperability in the 700 MHz Commercial Spectrum	)	WT Docket No. 12-69
	)	
	)	
Interoperability of Mobile User Equipment Across Paired Commercial Spectrum Blocks in the 700 MHz Band	)	RM-11592 (Terminated)
	)	

REPLY COMMENTS OF DISH NETWORK L.L.C.

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ATTACHMENT: Declaration of Mariam Sorond

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I. INTRODUCTION AND SUMMARY

In these reply comments, DISH Network Corporation ("DISH") respectfully submits that given the empirical data submitted in the record, the Commission should find that Lower 700 MHz E Block transmissions at currently authorized power levels do not pose a threat of harmful interference to devices operating in the Lower 700 MHz B and C Blocks. Since, as established by several commenters, Lower 700 MHz E Block operations have been shown not to increase harmful interference to Band 12 devices (devices that operate across the Lower 700 MHz A, B, and C Blocks), nothing in the current E Block service rules stands in the way of device interoperability in the Lower 700 MHz bands.[1] Technical conclusions advanced by AT&T and QUALCOMM that E Block transmissions would cause harmful interference to Band 12 devices are based on flawed methodology and assumptions, and therefore do not provide a sound

[1] *See* Cavalier Wireless LLC and Continuum 700 LLC Comments at 10-11 (June 1, 2012); Cellular South Comments at 11-12 (June 1, 2012); Rural Telecommunications Group Comments at 12 (June 1, 2012); United States Cellular at 18 (June 1, 2012); Vulcan Wireless LLC Comments at 12, 16-17 (June 1, 2012).

engineering basis for the Commission to adjust E Block power levels. AT&T and QUALCOMM provided no laboratory test data of 700 MHz devices or relevant field measurements to support their claims. In addition, claims that Lower 700 MHz E Block transmissions will cause interference to Lower 700 MHz Band 12 base stations are also based on faulty technical assumptions and, in any case, are beyond the scope of the questions the Commission has asked. As the Commission noted, this proceeding "[a]t its core" is about "whether a unified band class would result in harmful interference to Lower 700 MHz licensees in the B and C Blocks and whether, if harmful interference exists, it reasonably can be mitigated."[2]

II. THE RECORD CONFIRMS THAT CHANGING POWER LEVELS FOR THE E BLOCK IS UNNECESSARY TO ADVANCE INTEROPERABILITY, BECAUSE E BLOCK POWER LEVELS DO NOT IMPACT LOWER B AND C BLOCK DEVICE PERFORMANCE.

Changing currently authorized power levels in the Lower 700 MHz E Block is unnecessary to advance the goals of interoperability proposed in this proceeding. The record does not contain credible, empirically-based evidence that the Commission's 50 kW ERP limit would increase harmful interference to Lower B and C Block devices. Overturning previous Commission precedent that affirmed a 50 kW ERP power limit in the Lower 700 MHz E Block would neither serve the public interest nor promote interoperability.[3] Proponents of the Commission's interoperability mandate confirm that changing authorized power levels in the E

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[2] *See* Promoting Interoperability in the 700 MHz Commercial Spectrum; Interoperability of Mobile User Equipment Across Paired Commercial Spectrum Blocks in the 700 MHz Band, *Notice of Proposed Rulemaking*, WT Docket No. 12-69, RM-11592, FCC 12-31, at ¶ 3 (rel. Mar. 21, 2012) ("*Interoperability NPRM*").

[3] *See* 47 C.F.R. § 27.50(c)(7). *See also* Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, et al., *Report and Order and Further Notice of Proposed Rulemaking*, WT Docket No. 06-150, 22 FCC Rcd 8064, 8097 ¶ 88 (2007) ("*2007 Report and Order*"); Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59), *Report and Order*, GN Docket No. 01-74, 17 FCC Rcd 1022, 1064 ¶ 102 (2002) ("*2002 700 MHz Report and Order*").

Block is unnecessary to accomplish the goals of interoperability because such conditions "do not impact Lower B and C Block device performance and are not an interoperability prerequisite."[4] DISH agrees.

Several commenting parties have demonstrated that transmissions in the Lower 700 MHz E Block at currently authorized power levels will not cause harmful interference to devices operating in the Lower 700 MHz B and C Blocks. The report filed by a coalition of Lower 700 MHz A Block licensees (the "Test Report") concludes that high power E Block transmissions have no impact on Lower B and C Block device performance and therefore are not an obstacle to achieving interoperability.[5] The National Telecommunications Cooperative Association notes that the record already contains substantial evidence that "the threat of interference [from power levels in the Lower 700 MHz E Block] is overstated by AT&T,"[6] and cites the Vulcan Wireless LLC study's conclusion that E Block transmissions do not create an increased interference threat.[7] Similarly, "any interference that might exist from . . . the Lower 700 MHz E Block is interference that does not affect devices and that does not affect operators in the Lower 700 MHz B or C Blocks."[8]

Not only would changing E Block power levels be unnecessary to achieve interoperability, since 2002 the Commission has repeatedly affirmed that the 50 kW ERP power

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4 *See* Cavalier Wireless LLC and Continuum 700 LLC Comments at 11; King Street Wireless, L.P. Comments at 13 (June 1, 2012). *See also* Vulcan Wireless LLC Comments at 18.

5 *See* Letter from R. Nash Neyland, Cavalier Wireless LLC; Eric B. Graham, C Spire Wireless; E.B. Martin, Jr., Continuum 700 LLC; Allison C. DiNardo, King Street Wireless, L.P.; Mark A. Stachiw, MetroPCS Communications, Inc.; Grant B. Spellmeyer, U.S. Cellular; and Michele C. Farquhar, Counsel to Vulcan Wireless, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 12-69, Attachment at 5 (May 29, 2012) ("Test Report").

6 *See* National Telecommunications Cooperative Association Comments at 8 (June 1, 2012).

7 *Id.*

8 *See* Cellular South Inc. Comments at 12; *see also* Rural Telecommunications Group Comments at 12; United States Cellular Comments at 18; Vulcan Wireless LLC Comments at 12, 16-17.

limit established for the Lower 700 MHz E Block serves the public interest by fostering flexible use of the spectrum, while adequately mitigating concerns of harmful interference.[9] In 2007, the Commission reaffirmed the 50 kW ERP power level and expressly recognized that forcing incumbent users to operate at lower power levels after acquiring licenses at 50 kW ERP "would not be appropriate."[10] Indeed, DISH has spent years studying, developing, and testing video services that rely on power levels of 50 kW; requiring DISH to operate at lower power levels in the 700 MHz E Block could foreclose such new uses of the spectrum without advancing the interoperability goals of the instant proceeding.[11]

In addition to the Commission's public interest findings and DISH's own reliance on the 50 kW power limits, there are broader policy reasons for the Commission to maintain the current service rules in the Lower 700 MHz E Block. Parties who hold licenses in the Lower 700 MHz band bid on and purchased these licenses based on technical rules in place at the time of auction.[12] Changing authorized power levels or other established service rules post-auction could compromise the success of future auctions by giving bidders less certainty regarding proposed and planned uses of the spectrum they bid on. As the Consumer Electronics Association explains, "[i]n the interest of the long term success of its auction program, the Commission should not change the rules of the game by imposing new encumbrances on Lower

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9 *See 2002 700 MHz Report and Order* ¶¶ 102-03.

10 *See 2007 Report and Order* ¶ 96.

11 *See* DISH Network Corporation Comments at 8-9 (June 1, 2012).

12 DISH paid nearly $712 million to acquire 169 licenses in the Lower 700 MHz E Block after the 2008 auction based on service rules in place at the time.

700 MHz Band licenses."[13] Further, changing established service rules will upset licensees settled expectations, which could have a detrimental impact on the competitive marketplace.

III. TECHNICAL REPORTS CLAIMING THAT CURRENT E BLOCK POWER LEVELS WILL CAUSE BAND 12 DEVICE BLOCKING ARE BASED ON FLAWED DATA AND DEFECTIVE TECHNICAL ASSUMPTIONS.

Technical reports claiming that E Block power levels have the potential to cause Band 12 device blocking are based on flawed data and technical assumptions. As a result, they provide no data that would justify any service rule changes with respect to the E Block, either to advance the cause of device interoperability, or for any other purpose.

A. QUALCOMM's Claims With Respect to Device Blocking and Intermodulation Interference Should Be Rejected.

In its initial comments, QUALCOMM made two interference claims related to the Lower E Block: device receiver blocking from the nearby strong signal, and intermodulation interference from the combination of the device transmission signal and the Lower E Block signal in the receiver low-noise amplifier ("LNA"). Both claims should be rejected, because QUALCOMM's conclusions rely upon faulty technical assumptions and fail to account for actual performance of current commercial devices.

First, QUALCOMM's claims that the Lower E Block will cause device receiver blocking to Band 12 devices are based on artificially poor device performance assumptions. In particular, QUALCOMM appears not to have performed laboratory tests of 700 MHz components or devices, and instead merely assumed the minimum 3GPP receiver selectivity as the performance

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[13] *See* Consumer Electronics Association Comments at 6 (June 1, 2012) ("These licenses were auctioned under a specific, fully-disclosed set of technical and operating rules, which were adopted after public notice and comment, and after a full consideration of the band plan and its attendant interference issues."); *see also* Communications Liberty and Innovation Project Comments at 2 (June 1, 2012) ("Imposing technology mandates only after the deployment of systems based on consensus-based industry standards that are in full compliance with the Commission's rules would be manifestly unjust, deter investment in mobile infrastructure, and inhibit innovation.").

metric for Band 12 devices.[14] Having done so, QUALCOMM provided no proof that commercial 700 MHz devices would perform so poorly.[15] In contrast, the Test Report demonstrated through *laboratory tests* using *current commercial devices* that commercial 700 MHz devices performed significantly better than QUALCOMM's assumptions.[16] If QUALCOMM had used actual device performance levels in its theoretical models, then the Band 12 device would show no harmful interference from E Block transmissions at currently authorized power levels.[17]

In addition, QUALCOMM's assumptions depart from actual device performance levels in that they used artificially low device blocking levels. The device blocking levels QUALCOMM used, which are set forth in Tables 2 and 3 in QUALCOMM's initial comments,[18] are significantly worse than the laboratory test results for devices as reported in the Test Report.[19] For instance, in Table 2, QUALCOMM used the 3GPP minimum blocking specification of -56 dBm for the in-band blocking specification, and then claimed that a signal of -17 dBm would be 39 dB higher than this level (-17 - (-56) dBm = 39 dB).[20] In Table 4.4 of the Test Report, however, the commercial LTE device exhibited normal performance with an interfering signal of -16 dBm. In other words, had QUALCOMM used actual device

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14 *See* Declaration of Mariam Sorond, Vice President for Technology Development, DISH Network Corporation ¶ 7 ("Sorond Declaration") (attached).

15 *Id.*

16 *See* Test Report at 23-25.

17 *See* Sorond Declaration ¶ 7.

18 *See* QUALCOMM Inc. Comments at 10-11 (June 1, 2012).

19 *See* Sorond Declaration ¶ 8.

20 *Id.*

performance levels as validated in the Test Report, then Table 2 would not have shown any interference from the E Block.[21]

Analysis of QUALCOMM's Table 3[22] shows a similarly flawed approach. QUALCOMM used a second-adjacent channel blocking assumption of 43 dB for a Band 12 device.[23] The Test Report's laboratory tests demonstrated a 73 dB second-adjacent blocking level, 30 dB better than QUALCOMM's assumption.[24] As the Test Report notes, "[t]ests of the second-adjacent channel (Lower A) demonstrated a tolerance for interfering signals 73 to 74 dB stronger than the desired signal, [and this in-band blocking] performance is 39 dB better than the 3GPP reference receiver specification."[25] By applying the Test Report commercial device performance assumptions to QUALCOMM's hypothetical Table 3, the Band 12 performance improves by 30 dB.[26] The 30 dB improvement would add directly to all of the numbers in QUALCOMM's table, and the corrected table would show no interference for ground-level E Block signals.[27] As a result, QUALCOMM's claims of Band 12 device blocking due to E Block signals at current power levels should be rejected given the reliance upon device performance levels that are drastically worse than actual commercial devices.

QUALCOMM's claims that Lower E Block transmissions cause interference to Band 12 devices because of the intermodulation of the Lower E Block signal with the device transmissions are similarly inaccurate and technically flawed. Once again, QUALCOMM did

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21 *Id*.

22 *See* QUALCOMM Inc. Comments at 11.

23 *Id.* at 10, FN 13 ("Qualcomm added the Band 12 filter rejection (7dB) and the blocker rejection of 43 dB . . .").

24 *See* Test Report at 23-24, Tables 4.3 and 4.4.

25 *Id.* at 24.

26 *See* Sorond Declaration ¶ 9.

27 *Id.* Table 1.

not measure actual commercial components or devices to determine their performance. A properly designed 700 MHz device would use a receiver low-noise amplifier (LNA) with sufficient linearity to avoid any intermodulation interference, yet QUALCOMM did not identify the linearity it assumed for the LNA in a Band 12 device.[28] QUALCOMM performed simulations using an internally-developed QUALCOMM tool to estimate intermodulation in the device LNA, yet did not provide the simulation inputs or methodology such that a third party could independently validate the results. Given that QUALCOMM appears to have failed to account for an important factor that would reduce interference (a properly designed LNA), and did not provide sufficient information to explain the assumptions used in its simulations, the Commission should reject QUALCOMM's claims of intermodulation interference from the E Block to Band 12 devices.

B. AT&T's Claims Regarding the Impact of E Block Transmissions to Band 12 Devices Are Technically Flawed and Should Be Rejected.

AT&T's technical report[29] prepared by Jeffrey H. Reed and Nishith D. Tripathi (the "AT&T Technical Report") is faulty and provides no basis for altering E Block service rules. In particular, it misapplies both 3GPP LTE device specifications and the receiver blocking interference mechanisms.

1) The AT&T Technical Report Misinterprets the Relevant 3GPP LTE Device Specifications.

The AT&T Technical Report misinterpreted the relevant 3GPP specification (TS 36.101)[30] by claiming that the *desired* signal must be 33 dB stronger than the *adjacent* signal to

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[28] *Id.* ¶ 10.

[29] *See* AT&T Services Inc. Comments, Exhibit A, *Impact of Channel 51 and E Block Interference on Band 12 and Band 17 User Equipment Receivers* ("AT&T Technical Report").

[30] AT&T Technical Report at 7 ("That is why the international standards and specifications for LTE developed by the 3GPP include SIR specifications of at least 33 dB, which means that to meet the 3GPP

avoid adjacent channel interference.[31] In fact, the TS 36.101 specification states the opposite—the *adjacent* signal may be 33 dB stronger than the *desired* signal.[32] Therefore, an LTE device, whether Band 12 or Band 17, is designed to operate normally in the vicinity of stronger nearby signals such as the E Block, without reliance on the RF filter for attenuation of nearby channels.[33] AT&T's misinterpretation of the specifications leads them to draw incorrect conclusions about the possibility of Band 12 interference from E Block signals.

2) The AT&T Technical Report Misinterprets Receiver Blocking Mechanisms in Band 12 and Band 17 Devices.

The AT&T Technical Report also misunderstands the mechanism of receiver blocking and the duplexer's involvement in the receiver blocking discussion in its attempt to claim the superiority of Band 17 for interference protection purposes. Figure 2 of the AT&T Technical Report purports to illustrate the Band 17 RF receiver filter advantage as compared to Band 12,[34] and the accompanying text described this filter as reducing the amount of E Block emissions interference within the Lower B and C Blocks. However, the claims regarding Figure 2 are flawed in multiple respects.

First, Figure 2 illustrated the out-of-band emissions (OOBE) purportedly coming into the Lower B and C Blocks from an E Block transmitter. However, the level of OOBE energy falling within the Lower B and C Blocks from E Block is purely a function of the E Block *transmit* filter. The device RF filter in devices operating in the B and C Blocks has no impact on this in-

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minimum performance specifications the strength of the desired signal must be at least 2000 times the strength of the adjacent channel interference at the receiver.").

[31] *See* Sorond Declaration ¶ 12.

[32] 3GPP TS 36.101 v8.14.0 2011-06 "Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE) radio transmission and reception", section 7.5.1. *See also* Sorond Declaration ¶ 12.

[33] *See* Sorond Declaration ¶ 12.

[34] *See* AT&T Technical Report at 15.

band interference level, contrary to claims made in the AT&T Technical Report.[35] It is physically impossible for a receive filter to remove OOBE interference from within the receive channel, thus the OOBE from the E Block will be identical for Band 12 and Band 17. As a result, Band 12 and Band 17 devices would perform identically in the presence of Lower E Block OOBE, and there is no basis for AT&T to claim that Band 17 is better able to reject OOBE from the E Block compared to Band 12.[36]

Second, the AT&T Technical Report erroneously claims that an E Block signal may impact the signal-to-interference ratio (SIR) within the B and C Blocks (Band 17).[37] The correct definition of SIR is the ratio of the signal to the interference falling within the same channel.[38] Only OOBE would impact the SIR and, as mentioned above, OOBE would be identical for both device filters, because it is physically impossible for a receive filter to remove OOBE interference from within the receive channel.[39] Therefore, there is no basis to claim that transmissions from the E Block would impact SIR differently for Band 12 versus Band 17 devices.

Third, the AT&T Technical Report incorrectly claims that E Block signals may cause temperature rise and component damage to Band 12 devices.[40] Such a claim is false, as demonstrated in the Test Report. Laboratory tests exposed devices to E Block signal levels

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35 *See* Sorond Declaration ¶ 13.

36 *Id*.

37 AT&T Technical Report at 14 ("It is well understood that high-powered E block transmissions will cause interference and hence decrease SIRs for Band 12 devices, and less so for Band 17 devices.").

38 *See* Sorond Declaration ¶ 14.

39 *Id*.

40 AT&T Technical Report at 15 ("Overloading occurs when the total signal strength at the receiver – i.e., the sum of ACI and the desired signal – increases the temperature of the device to such an extent that it causes damage to the devices' electronic circuits.").

greater than what would be encountered in an operational E Block market, without damage to the circuitry.[41] The blocking tests demonstrated that LTE commercial devices are designed to perform normally in the presence of nearby signals such as those presented by E Block towers.[42]

IV. CLAIMS THAT E BLOCK TRANSMISSIONS WILL IMPACT LOWER 700 MHz BAND 12 BASE STATIONS ARE UNFOUNDED, AND ARE BEYOND THE SCOPE OF THIS PROCEEDING.

Several parties erroneously claim that E Block transmissions at current power levels would impact the performance of A Block base stations.[43] To alleviate potential interference, parties ask the Commission to impose conditions similar to those agreed to by AT&T during the AT&T/QUALCOMM transaction.[44] As an initial matter, potential interference to Band 12 base stations is beyond the scope of this proceeding. As the Commission explains in the NPRM: "At its core, the dispute is whether a unified band class would result in harmful interference to Lower 700 MHz licensees in the B and C Blocks and whether, if harmful interference exists, it reasonably can be mitigated."[45] In addition, the Commission acknowledged that some industry members have raised "other interference issues that are specific to operations in the A Block" but explicitly stated that it would not "address those issues herein" and would instead "focus the

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41 *See* Test Report at 23-24, Tables 4.3 and 4.4.

42 *See* Sorond Declaration ¶ 15.

43 *See* AT&T Technical Report at 8 ("E block broadcasts cause interference within the frequency ranges used by base stations to receive transmissions from mobile devices"); Cellular South, Inc. Comments at 13 ("The possibility of interference [from the Lower 700 MHz E Block] was then, and remains today, merely a deployment issue that affects the placement of cell sites in the design of an LTE network in the Lower 700 MHz A Block"); T-Mobile USA, Inc. Comments at 17-19 (arguing that Lower 700 MHz E Block interference to Band Class 12 base station reception may require additional protection or the *AT&T/QUALCOMM* conditions); and Vulcan Wireless LLC Comments at 18 ("high powered E Block transmissions impact how A Block licensees can deploy their base stations.").

44 *See* AT&T Services Inc. Comments at 49; T-Mobile USA Inc. Comments at 17-19.

45 *See Interoperability NPRM* ¶ 3.

scope of this proceeding to interference to Lower 700 MHz B and C Block operations that may result from the adoption of Band Class 12 devices by Lower 700 MHz B and C licensees[.]"[46]

In any case, a system deployed in the Lower E Block is separated by 6 MHz from the nearest Band 12 (or Band 17) base station receive band. A base station RF filter with 6 MHz of frequency separation is more than sufficient to avoid interference to Band 12 base stations.[47] 3GPP contributions suggest that even a 2 MHz separation is sufficient to comply with 3GPP coexistence criteria.[48] More importantly, however, DISH's planned use of its E Block licenses is entirely different from AT&T's plans for its combined D and E Block licenses, meaning that the conditions imposed on AT&T as a condition of its acquisition of QUALCOMM's licenses are unnecessary and inappropriate for other licensees. Claims that Lower E Block transmissions will cause interference to Band 12 base stations appear to be based on AT&T's desire (expressed during the AT&T/QUALCOMM transaction in 2011) to use the Lower E Block *in conjunction with* the Lower D Block as an LTE supplemental downlink channel.[49] AT&T thus proposed using the Lower D and E Block spectrum as a *combined* channel that would be directly adjacent to the Lower 700 MHz Band 12 uplink band.[50] By contrast, DISH's planned operations would

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46 *Id.* ¶ 32.

47 *See* Sorond Declaration ¶ 18.

48 3GPP TSG RAN WG4 Mtg #60 Athens, Greece, 22-26 August 2011, R4-113985 "BS to BS coexistence between Band 12/17 and additional new 716-728 downlink". Also see 3GPP TSG RAN WG4 Mtg #61 San Francisco, USA, 14-18 November 2011, R4-115759 "Co-existence/co-location between LTE Downlink FDD 716-728 MHz and Band 17, 12", Ericsson-ST Ericsson.

49 *See* Application of AT&T Inc. and QUALCOMM Incorporated For Consent To Assign Licenses and Authorizations, *Order*, WT Docket No. 11-18, 26 FCC Rcd 17589, 17616-18 ¶ 66 (2011).

50 *Id.* ("Given the immediate adjacency of the D and C Blocks, we conclude that potential interference from D Block downlink operations is an especially significant threat to operations by C block licensees other than AT&T"). *See also* Sorond Declaration ¶ 17 ("AT&T proposed using the Lower D and E Block spectrum as an LTE supplemental downlink channel, employing a 10 MHz LTE channel for base station transmissions. This proposed use would place a base station downlink transmission in close proximity to a base station uplink, or receive, channel; the maximum frequency separation possible in this situation of D+E Block was 2 MHz in the case of a 10 MHz LTE channel in D and E.").

be confined to the E Block, which is 6 MHz away from the nearest Band 12 uplink bands, providing significant frequency separation for filtering of both systems.[51] Notably, parties who claim that E Block transmissions will cause interference to Band 12 base stations recognize that "these interference concerns are specific to base station deployment only, and are not in any way related to the topic of Lower 700 MHz device interoperability."[52]

V. CONCLUSION

The record contains ample evidence based on laboratory tests of actual commercial devices that E Block transmissions at current power levels will not increase interference to Band 12 devices. Claims to the contrary are based upon faulty and unrealistic technical assumptions. As a result, the Commission should not lower power levels or make other modifications to the E Block services rules, because such changes are unnecessary to advance the cause of interoperability. Changing service rules for the E Block that already have been found to be in the public interest will upset industry expectations and reduce the flexibility of use for the spectrum, and without any countervailing public benefit.

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[51] Sorond Declaration ¶ 18.

[52] *See* Cellular South Inc. Comments at 11; *see also* T-Mobile USA, Inc. Comments at 17; Vulcan Wireless LLC Comments at 18

Respectfully submitted,

_____/s/_____

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July 16, 2012

DECLARATION OF MARIAM SOROND

I, Mariam Sorond, being over 18 years of age, swear and affirm as follows:

1. I make this declaration in support of the reply comments of DISH Network Corporation ("DISH") filed in response to the Notice of Proposed Rulemaking issued by the Federal Communications Commission ("Commission") in WT Docket No. 12-69 (FCC 12-31).

2. I am Vice President for Technology Development for DISH Network L.L.C. My duties in this role include evaluating DISH's spectrum holdings in the Lower 700 MHz Band E Block and supporting efforts to develop business opportunities using the licenses. Before DBSD North America, Inc. ("DBSD") was acquired by DISH, I was a Vice President for Technology Development at DBSD and oversaw its systems technology development. I am an engineer by training.

3. DISH holds 168 FCC licenses in the Lower 700 MHz E Block band (722-728 MHz) through its subsidiary, Manifest Wireless L.L.C. ("Manifest"). DISH won these licenses in the 700 MHz auction held in 2008, and paid nearly $712 million for them. The 700 MHz licenses were granted on February 20, 2009 and will expire on June 13, 2019. DISH subsequently planned and constructed a mobile video trial system covering Atlanta, Georgia.

4. In preparation for making this Declaration, I reviewed, among other things, the report titled "Lower 700 MHz Test Report: Laboratory and Field Testing of LTE Performance near Lower E Block and Channel 51 Broadcast Stations" dated April 11, 2012 and submitted for the record in WT Docket No. 12-69 on May 29, 2012 (the "Test Report"); the comments of QUALCOMM Inc. filed in WT Docket No. 12-69, RM-11592 on June 1, 2012 ("QUALCOMM Inc. Comments); and the comments of AT&T filed in WT Docket No. 12-69, RM-11592 and accompanying report entitled "Impact of Channel 51 and E Block Interference on Band 12 and Band 17 User Equipment Receivers" by H. Reed and Nishith D. Tripathi (the "AT&T Technical Report").

5. As noted in DISH's initial comments in this proceeding, I support the Test Report's conclusion that DISH E Block operations at current power levels will not cause harmful interference to Band 12 devices in the Lower 700 MHz B and C Blocks. My reasons for this position are set forth in my declaration to DISH's initial comments filed June 1, 2012 in this proceeding.

ANALYSIS OF QUALCOMM, INC. CLAIMS REGARDING E BLOCK

6. I address herein two interference claims made by QUALCOMM in its June 1, 2012 comments related to the Lower 700 MHz E Block: device receiver blocking from the nearby strong signal, and intermodulation interference from the combination of the device transmission signal and the Lower E Block signal in the receiver low-noise amplifier (LNA).[1]

[1] *See* QUALCOMM Inc. Comments at 4 (June 1, 2012).

7. In terms of receiver blocking, several technical flaws were evident in QUALCOMM's comments. QUALCOMM appears not to have performed laboratory tests of 700 MHz components or devices, and instead merely assumed the minimum 3GPP receiver selectivity as the performance metric for Band 12 devices. Having done so, QUALCOMM provided no proof that commercial 700 MHz devices would perform so poorly. In contrast, Test Report[2] demonstrated through laboratory tests using current commercial devices that commercial 700 MHz devices performed significantly better than QUALCOMM's assumptions. If QUALCOMM had used actual device performance levels in its theoretical models, then the Band 12 device would show no harmful interference from E Block transmissions at currently authorized power levels.

8. In particular, QUALCOMM's assumptions depart from actual device performance levels in that they used artificially low device blocking levels. The device blocking levels QUALCOMM used, which are set forth in Tables 2 and 3 in QUALCOMM's initial comments,[3] are significantly worse than the laboratory test results for devices as reported in the Test Report. For instance, in Table 2, QUALCOMM used the 3GPP minimum blocking specification of -56 dBm for the in-band blocking specification, and then claimed that a signal of -17 dBm would be 39 dB higher than this level (-17 -(-56) dBm = 39 dB). In Table 4.4 of the Test Report, however, the commercial LTE device exhibited normal performance with an interfering signal of -16 dBm. Had QUALCOMM used actual device performance levels as validated in the Test Report, then Table 2 would not have shown any interference from the E Block.

9. QUALCOMM's Table 3 also uses incorrect assumptions. In particular, QUALCOMM used a second-adjacent channel blocking assumption of 43 dB for a Band 12 device. The Test Report's laboratory tests demonstrated a 73 dB second-adjacent blocking level, 30 dB better than QUALCOMM's assumption. As the Test Report notes, "[t]ests of the second-adjacent channel (Lower A) demonstrated a tolerance for interfering signals 73 to 74 dB stronger than the desired signal, [and this in-band blocking] performance is 39 dB better than the 3GPP reference receiver specification." By applying the Test Report commercial device performance assumptions to QUALCOMM's hypothetical Table 3, the Band 12 performance improves by 30 dB. The 30 dB improvement would add directly to all of the numbers in QUALCOMM's table, and the corrected table (produced below as Table 1) would show no interference from ground-level E Block signals. As a result, QUALCOMM's claims of Band 12 device blocking due to E Block signals at current power levels should be rejected given the reliance upon device performance levels that are drastically worse than actual commercial devices.

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[2] *See* Letter from R. Nash Neyland, Cavalier Wireless LLC; Eric B. Graham, C Spire Wireless; E.B. Martin, Jr., Continuum 700 LLC; Allison C. DiNardo, King Street Wireless, L.P.; Mark A. Stachiw, MetroPCS Communications, Inc.; Grant B. Spellmeyer, U.S. Cellular; and Michele C. Farquhar, Counsel to Vulcan Wireless, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 12-69, Attachment (May 29, 2012) ("Test Report").

[3] QUALCOMM Inc. Comments at 10-11.

TABLE 1

Ch 56 Level @ UE Antenna Port (dBm)	Band 12 Duplexer		
	Level after Filter (dBm)	Ch 58 Desense (dB)	Ch 58/59 Desense (dB)
-20	-27	1.5	0
-30	-37	0	0
-40	-47	0	0
-50	-57	0	0

10. QUALCOMM's claims that Lower E Block transmissions cause interference to Band 12 devices because of the intermodulation of the Lower E Block signal with the device transmissions are inaccurate and technically flawed. QUALCOMM did not measure actual commercial components or devices to determine their performance. A properly designed 700 MHz device would use a receiver low-noise amplifier (LNA) with sufficient linearity to avoid any intermodulation interference, yet QUALCOMM did not identify the linearity it assumed for the LNA in a Band 12 device. QUALCOMM performed simulations using an internally-developed QUALCOMM tool to estimate intermodulation in the device LNA, yet did not provide the simulation inputs or methodology such that a third party could independently validate the results.

ANALYSIS OF AT&T CLAIMS WITH RESPECT TO E BLOCK

11. AT&T's technical report prepared by Jeffrey H. Reed and Nishith D. Tripathi (the "AT&T Technical Report") misapplies both 3GPP LTE device specifications and the receiver blocking interference mechanisms in its claims regarding the Lower 700 MHz E Block.

12. The AT&T Technical Report misinterpreted the relevant 3GPP specification (TS 36.101)[4] by claiming that the *desired* signal must be 33 dB stronger than the *adjacent* signal to avoid adjacent channel interference. In fact, the TS 36.101 specification states the opposite—the *adjacent* signal may be 33 dB stronger than the *desired* signal.[5] Therefore, an LTE device, whether Band 12 or Band 17, is designed to operate normally in the vicinity of stronger nearby signals such as the E Block. The device does not need to rely upon the RF filter alone to attenuate the E Block signal. AT&T's misinterpretation of the specifications leads them to draw incorrect conclusions about the possibility of Band 12 interference from E Block signals.

13. The AT&T Technical Report misunderstands the mechanism of receiver blocking and the duplexer's involvement in the receiver blocking discussion in its attempt to claim the

[4] *See* AT&T Services Inc. Comments, Exhibit A, *Impact of Channel 51 and E Block Interference on Band 12 and Band 17 User Equipment Receivers*, at 6 ("AT&T Technical Report") ("That is why the international standards and specifications for LTE developed by the 3GPP include SIR specifications of at least 33 dB, which means that to meet the 3GPP minimum performance specifications the strength of the desired signal must be at least 2000 times the strength of the adjacent channel interference at the receiver.").

[5] 3GPP TS 36.101 v8.14.0 2011-06 "Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE) radio transmission and reception," section 7.5.1.

superiority of Band 17 for interference protection purposes. Figure 2 in the AT&T Technical Report illustrates the out-of-band emissions (OOBE) purportedly coming into the Lower B and C Blocks from an E Block transmitter. However, the level of OOBE energy falling within the Lower B and C Blocks from the E Block is purely a function of the E Block *transmit* filter. The device RF filter in devices operating in the B and C Blocks has no impact on this in-band interference level, contrary to claims made in the AT&T Technical Report. It is physically impossible for a receive filter to remove OOBE interference from within the receive channel, thus the OOBE from the E Block will be identical for Band 12 and Band 17. As a result, Band 12 and Band 17 devices would perform identically in the presence of Lower E Block OOBE, and there is no basis for AT&T to claim that Band 17 is better able to reject OOBE from the E Block compared to Band 12.

14. The AT&T Technical Report erroneously claims that an E Block signal may impact the signal-to-interference ratio (SIR) within the B and C Blocks (Band 17).[6] The correct definition of SIR is the ratio of the signal to the interference falling within the same channel. Only OOBE would impact the SIR and, as mentioned above, OOBE would be identical for both device filters, because it is physically impossible for a receive filter to remove OOBE interference from within the receive channel.

15. The AT&T Technical Report incorrectly claims that E Block signals may cause temperature rise and component damage to Band 12 devices.[7] Such a claim is false, as demonstrated in the Test Report. Laboratory tests exposed devices to E Block signal levels greater than what would be encountered in an operational E Block market, without damage to the circuitry.[8] The blocking tests demonstrated that LTE commercial devices are designed to perform normally in the presence of nearby signals such as those presented by E Block towers.

ANALYSIS OF IMPACT TO BAND 12 BASE STATIONS FROM E BLOCK

16. I disagree with claims made in this proceeding that E Block transmissions at current power levels would impact the performance of Band 12 base stations.

17. In the original context of the AT&T-QUALCOMM license transfer, the interference claim held merit. The Lower E Block licenses in question in that transaction were proposed for use in conjunction with the Lower D Block. AT&T proposed using the Lower D and E Block spectrum as an LTE supplemental downlink channel, employing a 10 MHz LTE channel for base station transmissions. This proposed use would place a base station downlink transmission in close proximity to a base station uplink, or receive,

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6 AT&T Technical Report at 14 ("It is well understood that high-powered E block transmissions will cause interference and hence decrease SIRs for Band 12 devices, and less so for Band 17 devices.").

7 *Id.* at 15 ("Overloading occurs when the total signal strength at the receiver – *i.e.*, the sum of ACI and the desired signal – increases the temperature of the device to such an extent that it causes damage to the devices' electronic circuits.").

8 *See* Test Report at 23-24, Tables 4.3 and 4.4.

channel; the maximum frequency separation possible in this situation of D+E Block was 2 MHz in the case of a 10 MHz LTE channel in D and E.

18. On the other hand, a system deployed in the Lower E Block is separated by 6 MHz from the nearest Band 12 (or Band 17) base station receive band. A base station RF filter with 6 MHz of frequency separation is more than sufficient to avoid interference to Band 12 base stations. DISH's planned operations would be confined to the E Block, which is 6 MHz away from the nearest Band 12 uplink bands, providing significant frequency separation for filtering of both systems.

The foregoing declaration has been prepared using facts of which I have personal knowledge or belief or upon information provided to me. I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information, and belief.

Mariam Sorond

Mariam Sorond
Vice President, Technology Development
DISH Network L.L.C.

July 16, 2012